General Anesthesia for Eye Operations

A Consideration of Some Pertinent Factors Involved in Administration

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• **In the administration of general anesthesia for surgical operations on the eye, care must be taken to consider the patient's total physiological condition. A patient with eye problems may have generalized changes of more than moderate extent. Most patients are in the age group in which the incidence of cardiovascular and pulmonary problems is relatively high. If the patient is in a younger age group, perhaps diabetes or the collagen diseases must be suspected. Care must be taken to prevent undue strains to the eye during and immediately after the operation.**

Constant care and an awareness of possible complication is necessary for successful management in these cases.

GENERAL ANESTHESIA for surgical operations on the eyes is a means of obtaining the best surgical working conditions with safety to the patient and a minimum of postoperative disturbance. Better physical control is maintained over the patient while the eye is open and subject to loss of fluid. It is no longer necessary to depend on the cooperation of the patient not to cough or move at a critical moment. Moreover, there is always the possibility that unless he is asleep a patient who is normally most cooperative, but who has a tendency to claustrophobia, will feel confined under the drapes and become unmanageable. With children, general anesthesia is almost the only means of obtaining satisfactory surgical working conditions.

The surgeon having a trained anesthesiologist in attendance has the assurance of ready assistance in the management of the patient in the event of complications, such as allergic reactions, respiratory depression, congestive failure or cardiac arrest. He also has with him a qualified person available to administer other medication, such as insulin or glucose to a diabetic, or acetazolamide (Diamox®) to a patient with glaucoma. Further, medical problems of a cardiorespiratory type may be leavened by the selective use of positive pressure respiration with suction to remove secretions from the bronchial tree.

In operations involving surgical opening of the eye, it is most desirable to have the patient as quiet as possible during emergence from anesthesia and in the immediate postoperative period. A simple straightforward anesthetic procedure with few drugs is easier to keep in balance than one which is more complicated. When a great many drugs are used, especially where one drug is used to modify the action of a second, an uneven or stormy postoperative period may ensue, for not all drugs reach their peaks of effectiveness at the same time. Thus, a technique which produces a very desirable effect during operation may result in a very undesirable one some time later when the procedure is over but the eye perhaps is still vulnerable to postoperative injury.

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Drugs and agents which may be involved directly or indirectly in an anesthetic procedure fall into loose classifications. First are the hypnotics which produce a sleeping state but do not necessarily cover pain or surgical stimulus. Barbiturates are the main item in this group. Also in this group might be included most of the tranquilizers. If a hypnotic drug is relied upon for the major part of an anesthetic, the level will alter rapidly with changes in the level of stimulation; and at the end, when the stimulation has ceased, the patient may be in respiratory depression.

The second group includes the analgesics, largely the opiates, such as morphine and meperidine (Demerol®). These drugs control or relieve pain, and may or may not produce a sleeping state. Nitrous oxide belongs in this group, but used alone in safe concentrations it will not produce complete general anesthesia.

Third would be the so-called complete or 100 per cent anesthetic agents, such as the ethers, cyclopropane, chloroform and fluothane. These agents used alone are all capable of producing a full and adequate state of general anesthesia, covering both hypnotic and analgesic needs.

Next would come drugs and materials used to maintain and adjust physiological processes, such as oxygen, fluids, vasopressor agents, atropine-like drugs and relaxants of all kinds. These are neither hypnotics nor analgesics, but serve in the control and maintenance of bodily functions.

Finally, there are drugs that, although not administered by the anesthesiologist, must be taken into

consideration by him. They are drugs that are being taken by the patient for other purposes, usually but not always under the supervision of a physician. Among those that most frequently become problems are drugs of the rauwolfia serpentina group, some of which can cause a protracted and resistant state of hypotension when the patient is placed in a state of general anesthesia. Cortisone compounds have become a problem because of the atrophy of the adrenals which may go with prolonged use. This impairment of adrenal function may result in resistant hypotension in the face of stress. Tranquilizers also must be taken into account. They are supposed to potentiate the action of other hypnotics and analgesics and to have a mild action of their own. It is my opinion that they are in themselves very potent drugs. They tend to produce a lowered respiratory exchange and the patient's respirations may need constant assistance under the conditions of general anesthesia.

Premedication should not be excessively heavy. It is far easier to add drugs intravenously before or during the procedure than to overcome the effects of an excessive dose which results in inadequate respirations or greatly lowered blood pressure. If possible, the very long-acting drugs are best avoided so that postoperatively the drug effects will wear off in a reasonably orderly manner. Secobarbital (Seconal®) or a similar barbiturate is usually given two hours before scheduled time in 0.1 gm. dose. For children the dose is reduced. Meperidine (Demerol®) is preferred over morphine as an opiate as it is shorter-acting and less apt to produce nausea. The dosage used varies from 100 mg. to 12.5 mg., depending on the size and age of the patient. Atropine or scopolamine is given in doses of from 0.4 mg. to 0.2 mg. to produce satisfactory drying of secretions and to aid in limiting reflex activity. Patients with history of drug sensitivity do very well with diphenhydramine (Benadryl®) 50 mg. substituted for the barbiturates. Such patients usually arrive in the surgery relaxed but not asleep. While occasionally a patient does not cooperate well, respiratory depression and its associated pulmonary congestion and occasional mania are avoided.

Induction is usually with pentothal in 2 per cent solution, small doses being given until introduction of the oral airway is tolerated. Small doses of meperidine are given between the repeated doses of pentothal, until a light sleeping state is established which is not readily upset by pain or other stimulation. Further doses of appropriate drugs are given as the situation demands in order to maintain an even state of anesthesia. Preparation of the patient by the surgeon for operation is usually carried out while this level is being established, the gradually increasing stimulus being well suited for this purpose.

A clear airway is essential but can usually be obtained without tracheal intubation. A rubber oral airway is put in place and oxygen insufflated into the airway under the drape. In many cases the airway is greatly improved by the placement of a small, firm pillow under the shoulders to throw the head back a little. The patient then usually can maintain an adequate respiratory level without assistance. Oxygen insufflated at a rate of 2 to 3 liters a minute will not irritate the pharynx and is sufficient to provide a suitable atmosphere under the drapes, which without the addition would become deficient in oxygen and high in nitrogen, carbon dioxide and water vapor. Other anesthetic agents in the gas or vapor state are not well suited to insufflation under the drapes as it is almost impossible to accurately judge and control the concentrations which tend to build up. While adding some volatile agent to the insufflation would possibly speed the postoperating waking, smoothness of awakening is more to be desired than rapidity.

The surgeon may use a local anesthetic if he wishes, but it is by no means necessary. If he does, general anesthesia may not have to be quite as deep as it would be otherwise, but close cooperation between the members of the team is essential. In operations for correction of squint, traction on the muscles may cause a slowing of the pulse of the vagus type. This effect seems to be particularly severe where the medial rectus is under traction. Atropine, scopolamine and to a lesser extent meperidine all help reduce reflex activity of this type. Gentle continued traction can be used to fatigue the mechanism where blocking the enervation of the muscle is not practical.

Tracheal intubation is a very important technique in anesthesiology. It gives relative assurance of a clear airway, the opportunity to apply positive pressure respirations at any time and a protection of the respiratory passages from possible aspiration of secretions, blood or stomach contents. It has made possible the relatively recent advances in chest and cardiac operations. However, since great relaxation and a deep level of anesthesia are not generally required in operations on the eyes, intubation is seldom required. Specific indications for it are a need for positive pressure or respiratory assistance or for suction of secretions or protection of respiratory passages from aspiration of secretions, blood or stomach contents.

Need for respiratory assistance can be anticipated for patients having cardiac insufficiency with edema, for patients with pulmonary fibrosis and for those with very large abdomens. Suction is likely to be necessary for patients with chronic draining sinus-

itis, and protection from aspiration of blood must be provided for patients undergoing dacryocystorrhinostomy or removal of an orbital tumor. If the ocular operation is in connection with an accident involving other injuries, provision must be made for preventing aspiration of stomach contents.

The main difficulty with routine intubation is in the postoperative state, when persistent coughing may be a problem. Use of topical anesthesia to prevent irritation makes the patient vulnerable to aspiration of fluids or secretions during the recovery period and only delays the period of postoperative coughing. Some topical agents cause edema or irritation of the mucous membrane as they wear off.

An intubated patient must be constantly attended. The presence of a tube alone does not guarantee a clear airway. Although it enables one to assist the inspiratory phase of respiration, care must be taken not to interfere with expiration. Slight positive pressure on expiration can cause impaired filling of the heart and venous engorgement. Venous engorgement in turn can cause greatly increased intraocular pressure.[1] It must be borne in mind that the mere presence of a tube reduces the diameter of available air passage, not only by the thickness of the walls of the tube but further by fittings which slip into the tube. and still further by bends in connectors and adapters. Any reduction in available diameter increases the resistance to flow of gases to the fourth power. Thus, if the available diameter were reduced to one-half, the resistance to flow would increase 256 times. Other factors involved in resistance, such as the length of the tube, are dealt with at length by Macintosh and Mushin.[8]

Patients with severe pulmonary impairment, such as those with pulmonary fibrosis, require intubation both to clear secretions from the air passages and to aid respiration and circulation of blood through the pulmonary circuit. For such patients, high oxygen levels should be avoided, for in them, having as they do normally very high carbon dioxide levels, the respiratory drive mechanism is based on mild anoxia. If high oxygen levels are reached, these patients cease voluntary respirations and must be assisted, and when the operative procedure is completed it may be difficult to reestablish a voluntary respiratory pattern.

If laryngospasm develops during induction, the use of succinylcholine in 10.0 mg. dose usually relieves it. This drug has the advantage of leaving the laryngeal cords in the open position, and if anesthesia is light and the dosage small the patient will continue to breathe without assistance.

Lincoff,[7] Dillon[3] and Claythorne[2] among others have written about the increased intraocular pressure resulting from the administration of succinylcholine. This is due to spasm of the extraocular muscles, placing the eye under tension. The effect is not as pronounced with the patient under general anesthesia, and it is transient, lasting only as long as the drug action lasts.[6] This elevation in pressure is not so great as that which can be caused by venous stasis or contraction of the orbicularis muscle.[1] Before opening the eye many surgeons apply gentle pressure to it for a few minutes to lessen the fluid content within the rigid eye structure and thereby reduce the pressure from within during the operation.

My experience leads me to believe that succinylcholine used with care and in moderation under the conditions of light general anesthesia does not produce significant increase in intraocular pressure during the period the eye is open.

In a period of two years I administered general anesthesia for ocular procedures in 465 cases. In almost all of them an intravenous technique with oxygen insufflation was used. Children under 2 years of age were usually given ether anesthesia. Nine of the patients were intubated, for various reasons; and in one case operation was cancelled because of a purulent postnasal discharge.

Constant monitoring of the patient's condition is essential for the successful management of the anesthetic and the safety of the patient. Electronic cardiac monitor units which give an audible signal may be used. However, as with anything of a mechanical nature, these too must be checked from time to time to keep them free of error. I prefer a long stethoscope, with a very large diaphragm which is placed over the precordial area. If it is placed a little high it will also serve to check on the left main bronchus. The bows have been loosened so that one side can be placed in an ear while the other side rests against the cheek, leaving one ear available for conversation while the other monitors cardiac and respiratory sounds. Both sides may be placed in the ears if more careful listening is necessary. Hearing is kept more attentive by shifting from one ear to the other for monitoring purposes. For a time I used a hearing aid ear piece which fitted into the ear and was connected to the stethoscope, but over a period of time there was a tendency to ignore the sounds in the one ear and the mechanism lost its usefulness. If the tube through which oxygen is being insufflated is disconnected from the source of oxygen and the end placed in the ear, the sounds of respiration at the rubber airway may be heard directly. A standard blood pressure cuff on the arm completes the equipment for monitoring the patient's physiological condition. A change in the respiratory cycle is one of the earliest indications of lightening anesthesia, although a sudden change in the degree of surgical stimulation may also affect the cycle. Constant attention to such relatively minor details enables

one to make the nice distinction between mere reacting or coughing and respiratory distress. When a patient is intubated it is easier to monitor the respirations and even to control them, but taking the postoperative period into account, it may be more difficult to manage the entire procedure smoothly.

The details of management of the individual case must be left to the individual anesthesiologist at the time of operation. It is impossible to forecast accurately how each person will react to each of the many stimuli, drugs and procedures involved.

Of the many complications which may be encountered in the administration of anesthesia, either general or local, cardiac arrest is the most extreme. Recent reports by Kouwenhoven[5] and others on external cardiac massage present an approach to the problem which should be well adapted to ocular operations, for the patient is already supine on a firm elevated surface at a satisfactory working height for the necessary intermittent application of force over the lower portion of the sternum. However, if satisfactory results are not obtained in one minute or at most two minutes of external massage, the chest must be opened and the established procedure of direct cardiac massage instituted.

Regardless of which method is used, artificial respiration must be instituted, either by mouth-to-mouth breathing or preferably by intubation and use of an anesthetic machine.

Jacoby[4] said recently that positive pressure ventilation of a person with cardiac arrest will sometimes reestablish the circulation and normal heart beat. If arrest is detected early the heart is much easier to start. Whatever procedure is used must be well under way within three minutes if a good result is to be realized.

In one recent case, that of a child operated upon for correction of squint, the lungs became congested and the heart tones ceased shortly after the injection of a dilute solution of epinephrine. Firm application of pressure just below the sternum intermittently at a rate of twenty a minute reestablished the heart beat and then the respirations within thirty seconds. There were no discernible aftereffects.

My experience leads me to believe that it is not necessary in early or incipient cardiac arrest to apply pressure directly on the heart. A pulsating pressure produced within the thoracic cavity by positive pressure respirations or by pressure generally on the thorax, not specifically over the heart, will seemingly move blood by pressure on the vena cava and pulmonary vascular bed. If the heart is not fibrillating and is adequately filled, it will contract, even if only weakly. If not, the valves of the heart will limit the to-and-fro movement, and flow can be produced without an actual contraction. This intermittent pressure would also, at the same time, be applied to the pulmonary vascular bed, filling the left side of the heart, and blood will be moved into peripheral circulation.

Since cardiac arrest often seems to be due to interference with cardiac filling, the application of a pulsating force to the intrathoracic contents is worth a brief try.

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